Mapping physical sciences teachers' concerns regarding the new curriculum in South Africa

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This article reports on a study investigating physical sciences teachers' stages of concern (SoC) profiles during the implementation of the curriculum and assessment policy statement (CAPS) in South Africa. Throughout reform implementation, it is conceivable that teachers go through different SoC, ranging from giving low priority to the reform (unconcerned stage) to being preoccupied about how they can improve the innovation (refocusing stage). Previous studies have not focused on mapping teachers' SoC profiles during reform implementation in South Africa. Using the concerns-based adoption model (CBAM), the SoC questionnaire (SoCQ) was conducted with 81 physical sciences teachers from 62 schools in a South African district in the fifth year of CAPS implementation. Self-concerns were found to be dominant among the participants. Multivariate analysis of variance showed no significant differences between teachers' SoC profiles and their years of experience with the reform. This suggests that any programs of support offered so far may have had no significant impact in shifting teachers' SoC profiles. The regular use of the SoCQ to monitor teachers' progression through different SoC is recommended. Programs addressing the teachers' dominant concerns may thus be developed based on these understandings, thereby increasing the chances of successful implementation.

Introduction

The discrepancy between how policymakers envisage the implementation of reforms and teachers' actual implementation thereof has long been of concern to researchers (Drew, Priestly & Michael, 2016). In the initial years of curriculum implementation research, academics and policymakers led the studies amid frustrations at what they perceived as teachers' failures to implement curricula (Berman & McLaughlin, 1976). Seemingly, reform implementation has progressively evolved over the past decades. The detachment between those who design (policymakers) and those with a central role in the implementation process (teachers) appears to be narrowing. In the past three decades, research has shifted from a focus on frustrations about teachers' "failures and resistance" to mostly consider teachers' needs, sense making and teacher concerns (Drew et al., 2016). Tyre, Feuerborn and Woods (2018) considered it progressive for policymakers to acknowledge these concerns as it demonstrates respect for teachers' experiences, knowledge and insights.

More recently, teachers' concerns during curriculum implementation have been extensively studied using the CBAM framework in North America (Hao & Lee, 2016; Jennings, 2015; Tyre, Feuerborn & Woods, 2018). A considerable amount of study reports on teachers' concerns in the Middle East (Al-Shabatat, 2014; Gabby, Avargil, Herscovitza & Dori, 2017), in Asia (Loh & Tam, 2017; Meng, Sam & Osman, 2015; Nawastheen, Puteh & Meerah, 2014; Puteh, Abd Salam & Jusoff, 2011), in Euroasia (Çetinkaya, 2012)

and in Africa (Cobbold & Ani-Boi; 2011; Sarfo, Amankwa, Baafi-Frimpong & Asomani, 2016). Our substantial search of the literature did not yield any study reports focusing on South African teachers' concerns during times of curriculum reforms.

Since 1994, the South African Department of Basic Education (DBE) has introduced several reforms aimed at altering classroom practices and improving teaching and learning in subjects such as physical sciences. First, *Curriculum 2005* (C2005) was introduced, which was followed by the *National Curriculum Statement* (NCS). Recently, the *Curriculum and Assessment Policy Statement* (CAPS) was introduced (Department of Basic Education, 2011). Some experts believe C2005 failed because it was idealistic and overly ambitious, especially considering the economic and political climate of the time (Jansen, 1998; Taylor, Muller & Vinjevold, 2003). Jansen (1998) and Rogan and Grayson (2003) also added that previous innovations have failed due to too much focus on the *"what"* at the expense of a focus on the *"how"* of the reform programs. As per departmental reports (DBE, 2011), revision of C2005 came about because of the challenges faced during its implementation. Revision of C2005 resulted in the introduction the *National Curriculum Statement* (NCS). Furthermore, challenges in the implementation of the NCS resulted in another review in 2009, which gave rise to the new CAPS (DBE, 2011). Departmental documents confirm that the reason for the introduction of the new CAPS reforms stemmed from the need to resolve some of the challenges experienced during the implementing stages of the previous NCS (DBE, 2011).

Academics have attempted to explain and prescribe possible remedies for the challenges of curriculum implementation in the South African context (Cross, Mungadi & Rouhani, 2010; Chisholm, 2005; Chisholm, 2000; Jansen, 1998; Ramnarain & Fortus, 2013; Rogan & Grayson, 2003; Taylor & Cameron, 2016). Despite these significant contributions to the curriculum implementation discourse in South Africa, there are still knowledge gaps pertaining to teachers' concerns and their significance in the success (or failure) of curriculum implementation. An in-depth consideration of teachers' concerns in specific subject areas may broaden the knowledge base and assist in informing the present and future implementation of curricula in South Africa and elsewhere. This study maps out physical sciences teachers' stages of concern (SoC) during the current implementation process of the CAPS reform.

The literature reviewed suggests that, thus far, the implementation process of CAPS in physical sciences has been fraught with obstacles that may result in the failure of the reform taking root. Existing accounts have failed to shed light on teachers' potential concerns during the implementation process. This study systematically profiles physical sciences teachers' concerns using the concerns-based adoption model (CBAM) and the stages of concern questionnaire (SoCQ). These concerns profiles may assist policy makers in developing adequate intervention programs aimed at easing teachers' implementation of the reforms, and hence increase chances of successful implementation.

Research questions and hypotheses

Against this background, we proposed the following key question:

> What are physical sciences teachers' concerns on the new Curriculum and Assessment Policy Statements in the Motheo District of the Free State province of South Africa?

The main research question was explored by answering the following sub-questions:

1. What stages of concern profiles do practising physical sciences teachers exhibit (as of February 2016) during the implementation of the new CAPS curriculum?
2. What are the relationships, if any, between physical sciences teachers' stages of concern and demographic data such as their level of education, years of teaching experience and years of teaching under CAPS?

Question 2. above generated the following hypothesis:

> There is no significant difference between the mean raw scores of each of the stages of concern and the physical sciences teachers' demographic data such as their level of education, years of teaching experience or number of years of teaching under CAPS.
>
> *Independent variable*: Demographic data such as level of education, years of teaching experience or number of years of teaching under CAPS.
> *Dependent variables*: Stages of concern raw score

Below, we discuss both the CBAM as the theoretical framework for this study, and the SoC instrument that was used. Pertinent literature, in the form of recent research study on teachers' concerns, is discussed. An overview of the research methodology and the sampling procedures are also highlighted. In the end, we give a summary of the findings and the conclusions.

Theoretical framework: Concerns-based adoption model (CBAM)

The CBAM framework, developed by Hord and Hall at the University of Texas in 1973 (Christou, Eliophotou-Menon & Phillippou, 2004) frames this study. In recent decades, research has confirmed that resolving individual teachers' concerns increases the successful implementation of reforms in education (George, Hall & Stiegelbauer, 2013; Hord, Rutherford, Huling & Hall, 2006). Determining teachers' concerns can improve the quality of support programs that assist teachers during the implementation process (George et al., 2006). Concerns can be described as "…the feelings, thoughts, and reactions individuals have about a new program or innovation that touches their lives (Hord et al., 2006, p. 30). Fuller (1969) categorised teachers' concerns into three groups:

impact, self and task concerns. Impact concerns are about teachers' worries pertaining to students' outcomes; self-concerns involve preoccupations about how the innovation affects them as teachers, and task concerns relate to obstacles in the daily teaching duties such as the lack of resources and large classroom sizes. Fuller's framework thus laid a foundation for studies on teachers' concerns regarding educational reforms (Christou et al., 2004).

Although Fuller initiated research on teachers' concerns in the 1960s, it was Hall and Hord who developed CBAM as a research-based framework and methodology for the evaluation, description, measurement and explanation of various aspects of reform implementation (Christou et al., 2004). The CBAM framework describes how individuals evolve as they learn about the reforms and the stages of the reform process (Hord et al., 2006). CBAM is a set of tools that enables the understanding and management of change in teachers. The concerns-based adoption model has become a credible change framework used by a wide range of individuals planning for staff development in times of reform implementations (Hord et al., 2006).

CBAM is based on six assumptions (Hord et al., p. 5, 2006). Firstly, change should be a process. Secondly, change is accomplished by individuals. Thirdly, change is a personal experience. Fourthly, individuals go through different stages in how they feel about reforms and in their capacity and ability to align their practice with those reforms. The fifth assumption emphasises that change should be comprehended in operational terms. Finally, policymakers and those enforcing innovations must focus on individuals, the innovation, and the context in which this interaction takes place (Hord et al., 2006). The broad argument of CBAM is that if those in charge of policy reforms are to assist teachers, then they must be aware of the concerns that teachers harbour. Successful implementation of any curriculum innovation therefore depends on how the concerns of teachers as key implementers are addressed. However, the concerns that teachers harbour evolve as the implementation goes through different stages (Hall et al., 2006). CBAM can thus be employed to shed light on the type of barriers physical sciences teachers confront when adjusting to reform efforts in their teaching of the physical sciences components of the new CAPS. The concerns-based adoption model consists of three instruments: the SoCQ, the innovation configuration instrument, and the levels of use instrument. Below I discuss the instrument used in this study – the SoCQ.

Instrument: Stages of concern questionnaire

The SoC instrument incorporates the feelings and emotions that teachers might have during times of curricular change (Hord et al., 2006). There are seven developmental SoC: unconcerned (Stage 0), informational (Stage 1), personal (Stage 2), management (Stage 3), consequence (Stage 4), collaboration (Stage 5) and refocusing (Stage 6). The SoCQ enables the evaluation of these seven SoC. Once researchers have identified the general concerns of the group, they may be able to categorise the SoC of the group and its individual members and plan ways to support movement to a higher developmental level. The seven stages are further categorised into self-concerns (unconcerned, personal and informational), task concerns (management concerns), and impact concerns

(consequences, collaboration and refocusing). Table 1 presents a brief description of the seven SoC as elaborated by George et al. (2013).

Table 1: Typical expressions of concern about an innovation (George et al., 2013, p. 8)

	SoC	Expressions of concern
Impact	Refocusing	The individual focuses on exploring ways to reap more universal benefits from the innovation.
	Collaboration	The individual focuses on coordinating and cooperating with others regarding using the innovation.
	Consequences	The individual focuses on the innovation's impact on students.
Task	Management	Issues related to efficiency, organising, managing and scheduling dominate.
Self	Personal	The individual is uncertain about the demands of the innovation, his/her adequacy to meet those demands and/or his/her role with the innovation.
	Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it.
	Unconcerned	Degree of priority. The individual indicates little concern about or involvement with the innovation.

Findings from pertinent curriculum implementation research and CBAM

Worldwide studies using the CBAM framework have revealed wide ranging results that the developers caution should be treated as tentative hypotheses that may require further probing using other methods. Some studies revealed self-concerns as predominant (Al-Shabatat, 2014; Hao & Lee, 2016; Nawastheen et al., 2014; Meng et al., 2015), while others showed a predominance in task concerns (Tyre et al., 2018), with a few indicating a predominance of impact concerns. A few other studies reported multi-focal predominance: self-concerns and impact concerns (Çetinkaya, 2012; Gabby et al., 2017), and informational and consequence stages (Sarfo et al., 2016). Some studies reported no significant differences between female and male participants (Jennings, 2015), while some reported significant differences according to gender (Al-Shabatat, 2014; Hao & Lee, 2016; Sarfo et al., 2016), with Jennings (2015) concluding that females had more awareness and management concerns than their male conterparts.

Several studies reported sigificant differences of stages of concern profiles according to the level of education of the participants (Meng et al, 2015). Several studies reported significant differences in stages of concern profiles according to the participants' experiences (Jennings, 2015); however, other studies reported no significant differences of SoC due to the participants' experiences (Sarfo et al., 2016). The interpretations of the above findings are dependent on sample and the contexts of the studies. For example, when the stages of concern are centred on the self concerns, it might be helpful to know how many years between initiation of the innovation and administration of the questionnaire. It might take from 3 to 5 years for teachers to move from self-concerns to higher stages of concern (Van den Berg & Ros, 1999). While a few of these studies were conducted in Africa, none of them were conducted in South Africa.

Teachers' concerns during curriculum implementations in South Africa

While the review did not identify any studies directly focusing on physical sciences teachers' concerns during the CAPS implementation, several studies have sought to determine how the innovation was being implemented (Adu & Ngibe, 2014; Koopman, Le Grange & de Mink, 2016; Moodley, 2013; Nkosi, 2014; Ramatlapana & Makonye, 2013; Riffel, 2015; Taylor & Cameron, 2016; UMALUSI, 2014). Most of these studies focused on the analysis of the curriculum itself and not on teachers concerns, views or practices on the reform (UMALUSI, 2014). Ramatlapana and Makonye (2013) concluded that some teachers were not adhering to some of CAPS's academic demands and that the reasons for this non-adherence needed further research. It is plausible to conclude that some teachers have concerns that are hampering their effective adherence to the CAPS curriculum. In another study, analysis of data from focus group interviews, documents and observations led Moodley (2013) to conclude that generally teachers were receptive towards CAPS. Teachers who participated in the study reportedly cited clarity, structure, clear guidelines and timeframes as positive aspects of CAPS. The teachers, however, reported challenges related to quality and the amount of preparatory training, inadequate resources, increased workload and the impact of a rapid pace of the curriculum on teaching and learning (Moodley, 2013).

While the above studies provide important insights on some of the challenges teachers were facing during the implementation of CAPS, the present study provides important contributions to the implementation discourse by directly determining teachers' stages of concern profiles. For policy makers and change facilitators, such information may ease the designing of professional development programs aimed at supporting teachers who are struggling with CAPS implementation.

Research design and method

Copyright permission for using the SoC instrument, in line with intellectual property rights, was sought and obtained. The quantitative approach was employed using a stage of concern questionnaire (SoCQ) as the instrument. Each question on the SoCQ has a 7 point Likert-type scale (Irrelevant=0; Not true of me now=1,2; Somewhat true of me now=3, 4, 5; Very true of me now=6, 7). From those 35 questions, five of them belonged to each stage (unconcerned [stage 0], personal [stage 1], informational [stage 2], management [stage 3], consequence [stage 4], collaboration [stage 5] and refocusing [stage 6]). However, these were not grouped according to those stages; therefore, participants did not know which stage of concern any question belonged to. Participants would circle 7 if the statement was very true to them at the time; if the statement was somewhat true they would circle 4; if the statement was irrelevant they would circle 1 and if the statement was irrelevant or outdated to the participant then they would circle 0. Section B, whose data were collected as nominal, consisted of demographic data relating to the participants. This data consisted of level of education and number of years of teaching experience, how many years they had been teaching under CAPS, how many years of teaching experience they had overall and if they taught chemistry or physics topics or if they taught both.

Participants

The participants for the survey questionnaire were all grade 10 to 12 physical sciences teachers in the Motheo district. From 82 schools offering physical sciences (as of February 2016), 96 teachers from 69 schools consented to participating in the research and were handed the questionnaires. From those 96 physical sciences teachers, 81 completed the questionnaires (excluding the four pilot study participants). This represented a response rate of 88.5%. Most participants in this study (59.3%) were male. This almost coincides in percentage proportions with the composition of participants in a study by Ramatlapana and Makonye (2013), which had 31 males (59.6%) and 21 females (40.4%). Study participants were quite experienced with 85.2% having taught for at least five years. The demographic data shows that 14.8% had less than five years of experience as physical sciences teachers, while 24.7% had between five and ten years of experience in teaching, and 17.3% had been teaching for approximately 11 to 15 years while 22.2% had between 16 and 20 years of teaching experience. Those with more than twenty years of teaching experience constituted 21.0% of the participants. For educational qualifications, 45.7% had a certificate or a diploma, while 46.9% had attained a first degree, and those with a postgraduate qualification (either an honours or a Master's degree) constituted a mere 7.4%. While almost half of the participants (46.9%) had a major or minor in physical sciences, 28.4% had majored only in physics or physics education and 22.2% had majored in chemistry or chemistry education. In a few schools, teachers specialised in chemistry or physics, with most participants (92.6%) teaching both chemistry and physics, while 4.9% taught physics only and 2.5% taught chemistry only. This breakdown of academic qualifications in terms of physics and chemistry is often missing in studies of physical sciences teaching.

Data analysis

The developers recommend using percentile scores to SoC relative intensity graphs (George et al., 2006). Using the percentile conversion chart, the raw scores were converted into percentiles and these percentile scores were then used to construct individual profiles of the SoC relative intensity graphs. The raw scores and the percentile scores were entered as separate data files in the *Statistical Package for Social Sciences* (SPSS). The recommended procedure used to generate the whole cohort SoC profile involved getting the mean raw scores of the individuals at each stage (total scores divided by 81) and then averaging these by dividing them by the number of SoC (7). These mean raw scores were then converted to percentiles using the conversion chart (George et al., 2013). The demographic data on level of education, years of teaching experience and number of years of teaching under CAPS were used to test the hypotheses. One-way between-groups multivariate analyses of variance (MANOVA) with post hoc tests were conducted after verifying that the data met the required assumptions as suggested by Pallant (2013). For these analyses, raw scores rather than percentiles were used, as percentiles scores tend to skew the results to outliers (George et al., 2013, p. 27). The p-values were compared to 0.05 to observe the significance of any differences.

Findings

Individual relative intensity SoC profiles for all 81 participants were generated using the manual method as described above. Most of the participants had the highest concern at the unconcerned stage. Figure 1 shows an example of the SoC relative intensity profile of one of the participants, Thabo (pseudonym).

Thabo's profile

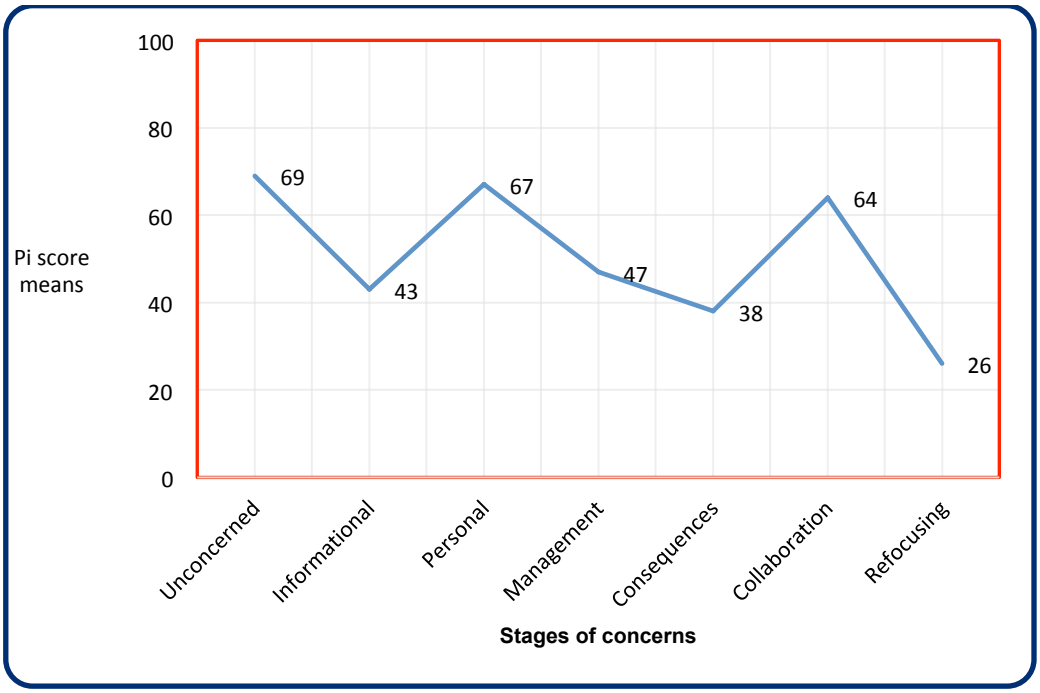

Figure 1: Thabo's profile: an example of an individual profile

Thabo's profile (Figure 1) has a multiple peak profile with the highest peak at unconcerned (69%); the second highest peak is at the personal stage (67%) and the third highest peak is at the collaboration stage (64%). Profiles, such as the one above, were generated for all the 81 participants (excluding the four participants for the pilot study).

Percentage distribution of highest peak stages of concern

Highest peaks indicate the stages where the concerns are most intense. The highest peaks and the corresponding SoC were located for each individual and then tallied under the groups of concerns. The numbers were then converted to percentages (Table 2). Most of the teachers (66.7%) had their peak scores at the unconcerned stage.

Table 2: Percentage distribution of highest peaks stages of concerns

	Highest (peak) stages of concern						
	Self-concerns			Task	Impact concerns		
	SoC0	SoC1	SoC2	SoC3	SoC4	SoC5	SoC6
No. of teachers	54	0	8	9	3	3	4
% of teachers	66.7	0.0	9.9	11.1	3.7	3.7	4.9

Whole cohort stages of concern profile

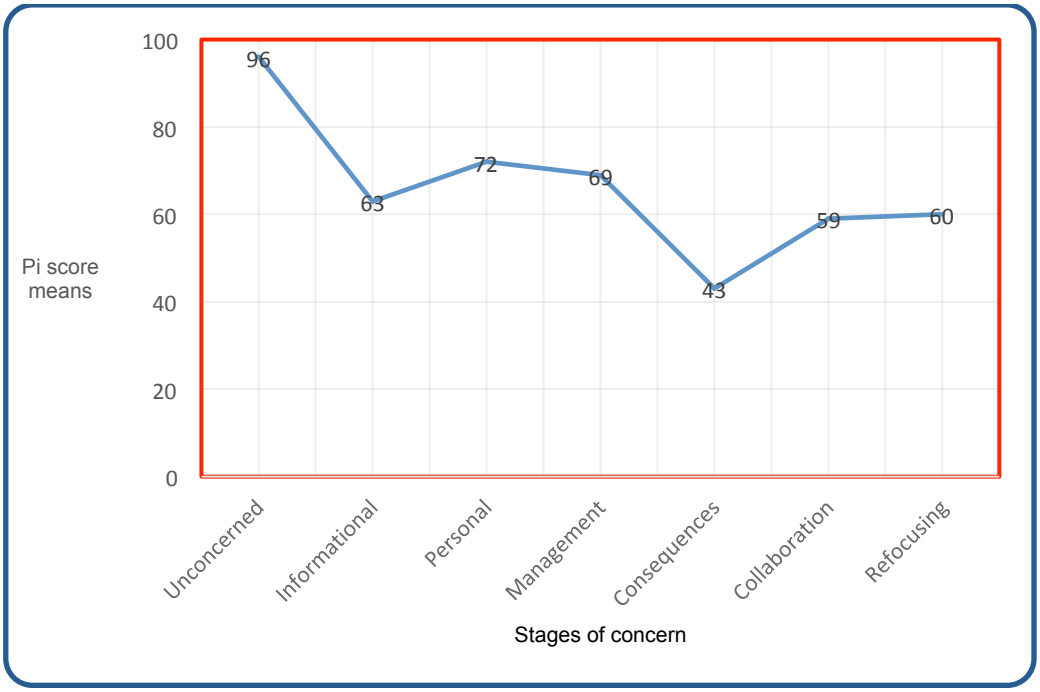

Figure 2: Whole cohort relative intensity stages of concern profile

The whole cohort's relative intensity profile (Figure 2) was generated by combining individual mean percentile scores of the individuals as described above. The highest percentile is at the unconcerned, with second and third peaks at personal and management respectively. Generally, physical sciences teachers' concerns were centred on the self-concerns, which is the lower SoC.

Level of education versus stages of concern raw scores

One-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate the impact of level of education on the SoC raw scores, as measured by the SoCQ. Participants were divided into two groups according to their educational qualifications: (1) Certificate/diploma and (2) University degree. The numbers at certificate and master's level were small, hence the groupings above, so that data could

have large enough frequencies to meet one of the criteria required for such an analysis. Statistically, there was no significant difference at the $p<0.05$ level between those with university degrees and those without university degrees on the SoC raw scores, $F(7, 73) = 2.12$; $p = 0.051$; Wilks lambda = 0.83. The MANOVA result implies that the raw score means of the relative level of intensity of concern at each stage of concern of those with university degrees and those without did not vary significantly.

Percentile score means vs level of education

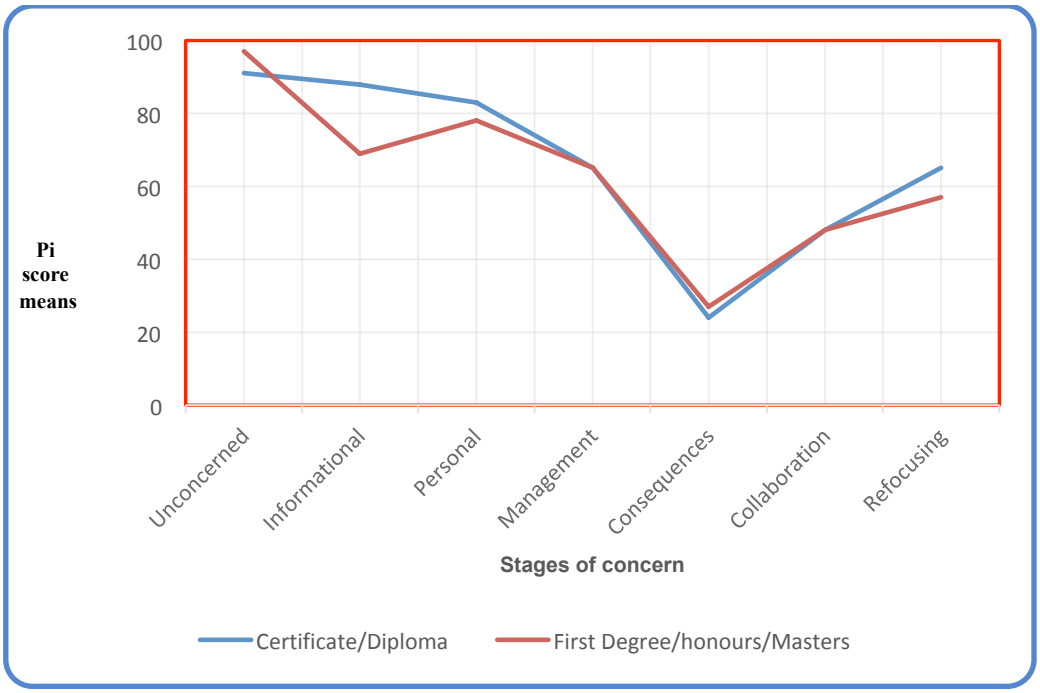

Figure 3: The relative intensity profiles according to level of education

Though there were no statistical differences between the group with certificate and diploma, and those with degree or higher qualifications, Figure 3 shows that those from the more educated group were less concerned about seeking more information about CAPS. The group with the less educated participants scored high on the refocusing stage. Both groups scored equally on the management and collaboration stages.

Number of years of teaching experience versus stages of concern raw scores

The MANOVA analysis was conducted to investigate the impact of number of years of teaching experience on the SoC, as measured by the SoCQ. One-way MANOVA tests were conducted to investigate the impact of number of years of teaching experience on the stages of concern raw scores. Participants were divided into five groups according to the number of years they had been teaching up to February 2016: (1) more than 20 years; (2) 16-20 years; (3) 11-15 years; (4) 5-10 years; (5) under 5 years.

Relative intensity according to years of experience

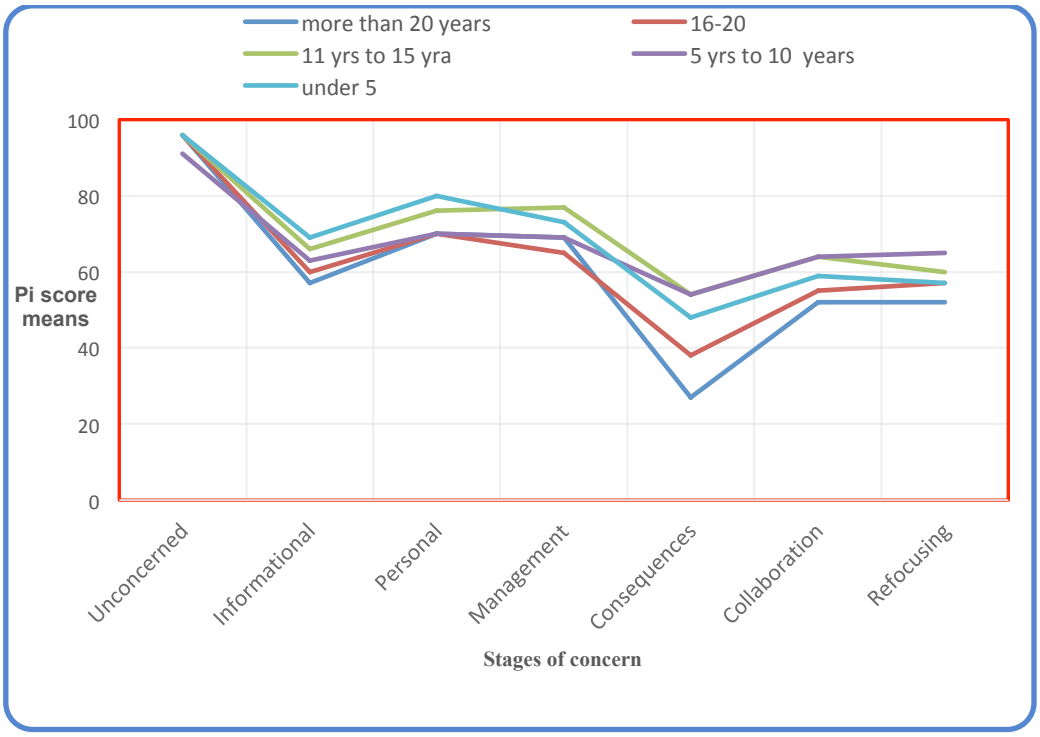

Figure 4: Years of teaching experience versus stages of concern

Statistically, there was no significant difference at the $p<0.05$ level among the four groups on the SoC scores, $F(28, 53) = 0.74$, $p = 0.83$; Wilks lambda = 0.76. The MANOVA analysis results imply that the raw score means of the relative level of intensity of concern at each stage did not vary significantly according to the number of years of teaching experience. Figure 4 shows the relative intensity profile according to years of experience of the participants. Participants with more than 20 years of teaching experience scored the least at the consequence stage of concern, suggesting that the impact CAPS was having on learners was not a priority.

Number of years of teaching under CAPS versus stages of concern

One-way between-groups multivariate analysis of variance (Manova) was conducted to investigate the impact number of years of teaching under CAPS on the stages of concerns, as measured by the SoCQ. The independent variable was number of years of teaching under CAPS. Participants were divided into four groups according to the number of years they had been teaching under CAPS as of December 2015 (Group 1: 4 years; Group 2: 3 years; Group 3: 2 years; Group 4: 1 year). Statistically, there was no significant difference at the $p<0.05$ level among the four groups on the stages of concerns scores, $F(21, 193) = 1.54$, $p = 0.068$; Wilks lambda = 0.64.

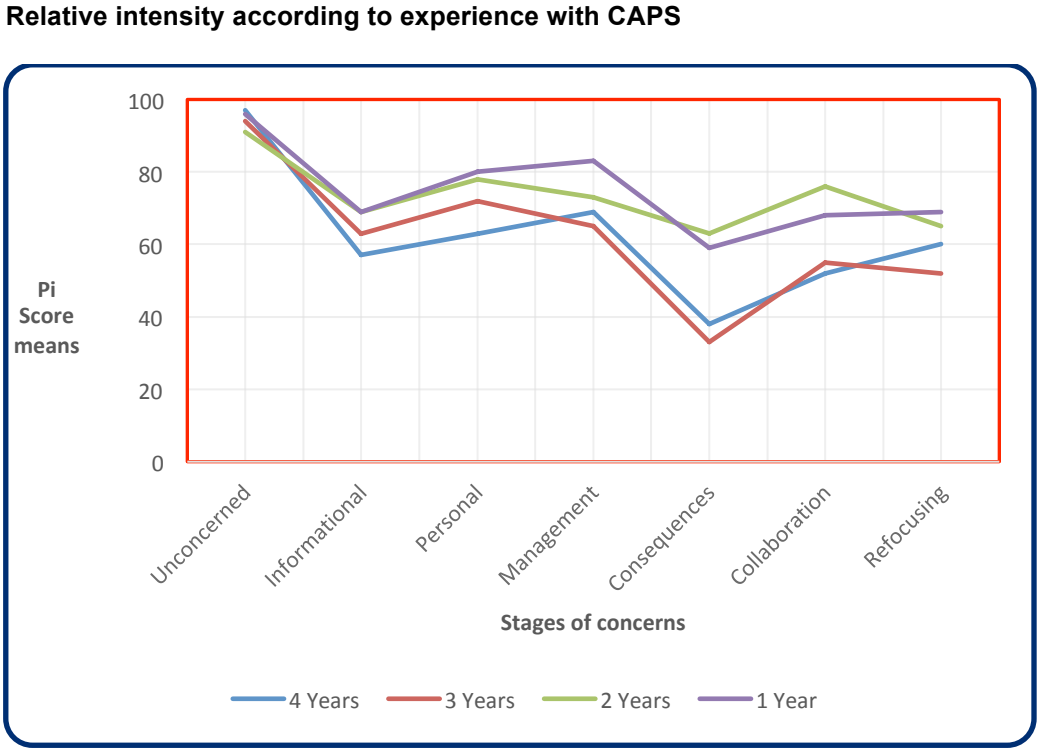

Figure 5: Raw score means vs years of experience with CAPS

Figure 5 shows the raw score means versus number of years of teaching under CAPS, constructed using the mean raw scores. The MANOVA analysis results imply that the raw score means of the relative level of intensity of concern at each stage of concern did not vary significantly according to the number of years of teaching under CAPS. The SoC profiles of those teachers who were in their fifth year of CAPS implementation did not vary significantly from the profiles of those teachers who were in their first year of CAPS implementation.

Discussion

The individual profiles revealed that most of the participants had the highest stage of concern at the unconcerned stage (Stage 0) and they were more centred on the self-concerns than on task or impact concerns. In a study on the adoption of a technology-enhanced learning environment to chemistry classes in Israel, Gabby et al. (2017) reported predominantly personal and impact concerns for teachers in their tenth year of implementation.

Interpretations of what the highest percentile scores at the unconcerned stage imply provided challenges during the earlier stages of the development of the SoCQ instrument (Hord & Hall, 2015). Revision and subsequent modifications of the statements of this

stage by the developers resulted in improved precision on what this stage measures. The unconcerned stage measures the degree of priority participants are giving to an innovation (George et al., 2013). The highest score on the unconcerned stage indicates that the participants were probably more concerned about other tasks and activities that were not necessarily about CAPS. We opine that in such cases, the second and third peaks become more significant at hinting what those tasks and activities could be. The second highest peak at the personal stage indicates that the participants were more concerned about how CAPS affects them personally and about how CAPS implementation benefits them on a personal level. They could have been more concerned about how CAPS made their work easier. It also indicates the possibility that teachers were uncertain about CAPS demands, or how these demands differed from the previous NCS demands. This raises the possibility that the majority of these teachers might have been uncertain about their role in the current implementation process.

The lowest score at the consequence stage suggests that most of the Motheo District physical sciences teachers were less concerned about how CAPS affects their learners. When an innovation is introduced, teachers' concerns are expected to gradually progress from lower to higher stages (George et al., 2013). It might take from 3 to 5 years for teachers to move from self-concerns to higher stages of concern (Van den Berg & Ros, 1999). When this expected progression takes place, the highest and second highest peaks are expected to be adjacent to each other (George et al., 2013). However, in this sample highest and second highest peaks are not adjacent to each other, hinting at a possible lack of the expected normal progression from lower to higher SoC. Most participants appeared to be preoccupied with self-concerns (mostly unconcerned and personal stages) which might be preventing the expected progression towards the higher concerns. Until their self-concerns are resolved, teachers' most intense concerns are most likely to remain centred on the lower SoC instead of progressing to the higher SoC such as collaboration and refocusing (George et al., 2013).

The one-way MANOVA tests confirmed the null hypothesis, suggesting no significant differences between raw scores of each of the SoC and physical sciences teachers' level of education, the number of years of teaching experience, or number of years of teaching under CAPS. These results differ from those in a study by Puteh et al. (2011) who, using a two-way ANOVA, found significant differences in raw scores according to academic qualifications among teachers. The MANOVA results suggest that teachers' experiences with the innovation had not significantly shifted the way they feel, think and perceive the innovation. Follow up contacts with the departmental authorities supervising the CAPS implementation confirmed that since its inception, the Department of Education had conducted professional development workshops with teachers aimed at supporting teachers in regards to CAPS implementation. However, we conclude that these support programs might have had very limited impact in assisting teachers to resolve challenges they may be confronting during CAPS implementation. This should be of concern to the authorities as it raises questions about the effectiveness of these support programs. The combination of the present findings, coupled with the scarcity of research studies targeting teachers' concerns, may suggest that the support programs might have been

developed and implemented without adequate understanding of teacher needs and challenges during the present curriculum implementation.

Conclusions

The gap between policymakers' envisaged classroom practices and teachers' actual practices during reform implementation could be narrowed when teachers' challenges and internal constraints during the adoption process are adequately resolved. The CBAM framework translates constraints that teachers confront during reforms into SoC profiles. These profiles can provide valuable insights about teachers' feelings and preoccupations to those formulating professional development programs. The SoC relative intensity profiles of the participants revealed that most of the Motheo district physical sciences teachers (76.6%) were still grappling with self-concerns and some task concerns, even though the CAPS curriculum was in its fifth year of adoption.

Furthermore, there is no evidence to suggest that teachers' experience with the innovation has made any significant difference in shifting physical sciences SoC profiles during the past four years of CAPS implementation. Thus, teachers in their fifth year of CAPS were found to be statistically at similar SoC as novice teachers in their first year with CAPS. Policymakers should be concerned as this raises questions about the effectiveness of the continuous professional development programs aimed at supporting teachers during CAPS implementation in the past four years. Teachers' continuous grappling with self-concerns may result in educators' indifference towards the reforms if these self-concerns are not resolved adequately.

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http://scholar.ufs.ac.za:8080/xmlui/bitstream/handle/11660/6528/GudyangaR.pdf?sequence=1

References

Al-Shabatat, A. M. (2014). Gifted' teachers stages of concerns for integrating e-learning in the gifted schools in Jordan. *Turkish Online Journal of Educational Technology*, 13(2), 79-87. http://www.tojet.net/articles/v13i2/1329.pdf

Adu, E. O. & Ngibe, N. C. P. (2014). Continuous change in curriculum: South African teachers' perceptions. *Mediterranean Journal of Social Sciences,* 5(23), 983-989. http://www.mcser.org/journal/index.php/mjss/article/view/4617

Berman, P. & McLaughlin, M. W. (1976). Implementation of educational innovations. *The Educational Forum*, 40(3), 345-370. https://doi.org/10.1080/00131727609336469

Çetinkaya, B. (2012). Understanding teachers in the midst of reform: Teachers' concerns about reformed sixth grade mathematics curriculum in Turkey. *Eurasia Journal of Mathematics, Science and Technology Education*, 8(3), 155-166. https://doi.org/10.12973/eurasia.2012.831a

Chisholm, L. (2005). The politics of curriculum review and revision in South Africa in regional context. *Compare: A Journal of Comparative and International Education*, 35(1), 79-100. https://doi.org/10.1080/03057920500033563

Chisholm, L. (2007). Diffusion of the National Qualifications Framework and outcomes-based education in southern and eastern Africa. *Comparative Education*, 43(2), 295-309. https://doi.org/10.1080/03050060701362631

Christou, C., Eliophotou-Menon, M. & Phillippou, G. (2004). Teachers' concerns regarding the adoption of a new mathematics curriculum: An application of CBAM. *Educational Studies in Mathematics*, 57(2), 157-176. https://doi.org/10.1023/B:EDUC.0000049271.01649.dd

Department of Basic Education (2011). *Curriculum and assessment policy statement (CAPS): Physical sciences*. Pretoria: Government Printers. http://schools.pearson.co.za/media/73588/physical-sciences-caps-fet-jan-2011.pdf

Drew, V., Priestley, M. & Michael, M. K. (2016). Curriculum development through critical collaborative professional enquiry. *Journal of Professional Capital and Community*, 1(1), 92-106. https://doi.org/10.1108/JPCC-09-2015-0006

Fuller, F. F. (1969). Concerns of teachers: A developmental conceptualization. *American Educational Research Journal*, 6(2), 207-226. https://doi.org/10.3102/00028312006002207

Gabby, S., Avargil, S., Herscovitz, O. & Dori, Y. J. (2017). The case of middle and high school chemistry teachers implementing technology: Using the concerns-based adoption model to assess change processes. *Chemistry Education Research and Practice*, 18, 214-232. https://doi.org/10.1039/C6RP00193A

George, A. A., Hall, G. E. & Stiegelbauer, S. M. (2013). *Measuring implementation in schools: The stages of concern questionnaire*. SEDL. http://www.sedl.org/pubs/catalog/items/cbam17.html

Hao, Y. & Lee, K. S. (2016). Teaching in flipped classrooms: Exploring pre-service teachers' concerns. *Computers in Human Behavior*, 57, 250-260. https://doi.org/10.1016/j.chb.2015.12.022

Hord, S. M., Rutherford, W. L., Huling-Austin, L. & Hall, G. E. (1998). *Taking charge of change*. Austin, Texas: Southwest Educational Development Library (SEDL). http://www.sedl.org/pubs/catalog/items/cha22.html

Jansen, J. D. (1998). Curriculum reform in South Africa: A critical analysis of outcomes-based education. *Cambridge Journal of Education*, 28(3), 321-331. https://doi.org/10.1080/0305764980280305

Jennings, S. T. (2015). *What concerns are secondary mathematics teachers experiencing with the implementation of the Common Core State Standards for Mathematics and is there a relationship between the concerns and professional development received?* Doctoral dissertation, University of Southern Mississippi. http://aquila.usm.edu/dissertations/116

Koopman, O., Le Grange, L. L. & De Mink, K. J. (2016). A narration of a physical science teacher's experience of implementing a new curriculum. *Education as Change*, 20(1), 435-452. http://dx.doi.org/10.17159/1947-9417/2016/560

Loh, E. K. Y. & Tam, L. C. W. (2017). The role of emotionality in teacher change: The case of Chinese language teachers in Hong Kong. *Teacher Development*, 21(3), 462-479. https://doi.org/10.1080/13664530.2016.1266381

Meng, C. C., Sam, L. C. & Osman, S. (2015). Primary school mathematics and science teachers' stages of concern about the implementation of lesson study. *Asia Pacific Journal of Educators and Education*, 30, 1-14. http://www.myjurnal.my/filebank/published_article/39561/1.pdf

Moodley, G. (2013). *Implementation of the curriculum and assessment policy statements: Challenges and implications for teaching and learning*. MEd dissertation, University of South Africa. http://hdl.handle.net/10500/13374

Nawastheen, F. M., Puteh, S. N. & Meerah, T. S. M. (2014). Teachers' levels of use of the 5E instructional model in the implementation of curriculum reforms in Sri Lanka. *Research Journal of Applied Sciences, Engineering and Technology*, 9(4), 191-200. https://www.researchgate.net/publication/281843665_Teachers%27_Levels_of_Use_of_the_5E_Instructional_Model_in_the_Implementation_of_Curriculum_Reforms_in_Sri_Lanka

Pallant, J. (2013). SPSS *survival manual: A step by step guide to data analysis using SPSS program*, 6th edition. London: McGraw-Hill Education.

Puteh, S. N., Azman, K., Salam, A. & Jusoff, K. (2011). Using CBAM to evaluate teachers' concerns in science literacy for human capital development at the preschool. *World Applied Sciences Journal*, 14, 81-87. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.389.7630&rep=rep1&type=pdf

Ramatlapana, K. & Makonye, J. P. (2012). From too much freedom to too much restriction: The case of teacher autonomy from National Curriculum Statement (NCS) to Curriculum and Assessment Statement (CAPS). *Africa Education Review*, 9(sup1), 7-25. https://doi.org/10.1080/18146627.2012.753185

Ramnarain, U. & Fortus, D. (2013). South African physical sciences teachers' perceptions of new content in a revised curriculum. *South African Journal of Education*, 33(1). http://dx.doi.org/10.15700/saje.v33n1a573

Riffel, A. D. (2015). An insight into a school's readiness to implement a CAPS related indigenous knowledge curriculum for meteorological sciences. *Universal Journal of Educational Research,* 3(11), 906-916. https://doi.org/10.13189/ujer.2015.031117

Rogan, J. M. & Grayson, D. J. (2003). Towards a theory of curriculum implementation with particular reference to science education in developing countries. *International Journal of Science Education*, 25(10), 1171-1204. https://doi.org/10.1080/09500690210145819

Sarfo, F. K., Amankwah, F., Baafi-frimpong, S. & Asomani, J. (2017). Concerns of teachers about the implementation of information and communication technology curriculum in basic education in Ghana. *Contemporary Educational Technology*, 8(2), 103-118. http://www.cedtech.net/articles/82/821.pdf

Taylor, D. L. & Cameron, A. (2016). Valuing IKS in successive South African physical sciences curricula. *African Journal of Research in Mathematics, Science and Technology Education*, 20(1), 35-44. https://doi.org/10.1080/10288457.2016.1147800

Tyre, A. D., Feuerborn, L. L. & Woods, L. (2018). Staff concerns in schools planning for and implementing school-wide positive behavior interventions and supports. *Contemporary School Psychology*, 22(1), 77-89. https://doi.org/10.1007/s40688-017-0130-5

UMALUSI (2014). *Curriculum Assessment Policy Statements (CAPS)*. Pretoria: UMALUSI. https://www.education.gov.za/Curriculum/CurriculumAssessmentPolicyStatements(CAPS).aspx

Van den Berg, R. & Ros, A. (1999). The permanent importance of the subjective reality of teachers during educational innovation: A concerns-based approach. *American Educational Research Journal,* 36(4), 879-906

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